

**FORT BELKNAP INDIAN COMMUNITY**  
**APPENDIX A-2**  
**Water Quality Criteria for Aquatic Life**  
**Revision No: 2 – July 1, 2021**

A-2: Numeric Criteria for Aquatic Life					
Pollutant (P = Priority Pollutant)	CAS Number	Freshwater CMC <sup>1</sup> (acute) (µg/L)	Freshwater CCC <sup>2</sup> (chronic) (µg/L)	Publication Year	Notes
[ HYPERLINK "https://www.epa.gov/wqc/ambient-aquatic-life-water-quality-criteria-acrolein" ] (P)	107028	3ug/L	3ug/L	2009	
[ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-aldrindieldrin" ] (P)	309002	3.0	—	1980	These criteria are based on the [ HYPERLINK "https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree" ] which used different Minimum Data Requirements and derivation procedures from the [ HYPERLINK "https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations" ]. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
Alkalinity	—	—	20000	1986	The CCC of 20mg/L is a minimum value except where alkalinity is naturally lower, in which case the criterion cannot be lower than 25% of the natural level.
alpha-Endosulfan (P)	959988	0.22	0.056	1980	These criteria are based on the [ HYPERLINK "https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree"

**Commented [WQC1]:** Footnotes created to clarify these are calculated at 100 mg/L hardness for hardness-based criteria found in Table 2 and that the criteria vary with hardness

**Commented [WQC2]:** NEED TO DISCUSS MORE

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					<p>] which used different Minimum Data Requirements and derivation procedures from the [ HYPERLINK "https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations" ]. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines. This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.</p>
<p>[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-aluminum" ] pH 5.0 - 10.5</p>	7429905	--	--	2018	<p>The criteria is based on the water chemistry data (for pH, hardness and DOC) entered into the criteria calculator for a given location.</p> <p>Criteria based on Approach 1 of the EPA Draft Technical Support Document: Implementing the 2018 Recommended Aquatic Life Water Quality Criteria for Aluminum – Table 1 Comparison of approaches to adopting the recommended aluminum criteria.</p> <p>(1) adopting the applicable sections of the 304(a) criteria document (which includes the criteria value calculator and criteria value lookup tables).</p>
<p>[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-ammonia" ]</p>	7664417	—	—	2013 (Freshwater )	<p>[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-ammonia" ] are pH, temperature and life-stage dependent.</p>
Arsenic	7440382	340	150	1995	<p>This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic. Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See [ HYPERLINK "https://www.epa.gov/wqc/office-water-policy-" ]</p>

**Commented [WQC3]:** NEED TO DISCUSS

**Commented [WQC4]:** NEED TO DISCUSS

**Commented [E5]:** Should this wording replace the above wording?

**Commented [WQC6]:** NEED TO DISCUSS VARIANCES

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					and-technical-guidance-interpretation-and-implementation-aquatic-life-metals" ].
[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-atrazine" ]	1912249				
beta-Endosulfan (P)	33213659	0.22	0.056	1980	These criteria are based on the [ HYPERLINK "https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree" ] which used different Minimum Data Requirements and derivation procedures from the [ HYPERLINK "https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations" ]. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines. This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	—	—	—	1986	See [ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ] for narrative statement.
[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-cadmium" ] [ P]	7440439	1.8	0.72	2016	<i>Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as CaCO3 to allow the presentation of representative criteria values.</i> Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See [ HYPERLINK "https://www.epa.gov/wqc/office-water-policy-and-technical-guidance-interpretation-and-implementation-aquatic-life-metals" ].

**Commented [WQC7]:** Should we use the 750 ug/L for agriculture? Where would this value be under Acute or Chronic or both?

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[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-carbaryl" ]	63252	2.1	2.1	2012	
[ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-chlordane" ] (P)	57749	2.4	0.0043	1980	These criteria are based on the [ HYPERLINK "https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree" ] which used different Minimum Data Requirements and derivation procedures from the [ HYPERLINK "https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations" ]. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-ambient-water-quality-criteria-chloride-1988" ]	16887006	860000	230000	1988	
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	7782505	19	11	1986	
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	2921882	0.083	0.041	1986	
[ HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water" ] (P)	16065831	570	74	1995	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See [ HYPERLINK "https://www.epa.gov/wqc/office-water-policy-and-technical-guidance-interpretation-and-implementation-aquatic-life-metals" ].

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					<i>The freshwater criterion for this metal is expressed as a function of hardness (mg/L). The value given here corresponds to a hardness of 100 mg/L.</i>
[ HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water" ] (P)	18540299	16	11	1995	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See [ HYPERLINK "https://www.epa.gov/wqc/office-water-policy-and-technical-guidance-interpretation-and-implementation-aquatic-life-metals" ].
[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-copper" ] (P)	7440508	—	—	2007	Freshwater criteria calculated using the Biotic Ligand Model. Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See [ HYPERLINK "https://www.epa.gov/wqc/office-water-policy-and-technical-guidance-interpretation-and-implementation-aquatic-life-metals" ].
[ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-cyanide" ] (P)	57125	22	5.2	1985	These recommended water quality criteria are expressed as µg free cyanide (CN/L).
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	8065483	—	0.1	1985	
[ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-diazinon" ]	333415	0.17ug/L	0.17ug/L	2005	

Commented [WQC8]: NEED TO DISCUSS

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[ <a href="https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water">HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water"</a> ] (P)	60571	0.24	0.056	1995	The freshwater CCC criterion and both Saltwater criteria are based on the [ <a href="https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree">HYPERLINK "https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree"</a> ] which used different Minimum Data Requirements and derivation procedures from the [ <a href="https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations">HYPERLINK "https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations"</a> ]. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
[ <a href="https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water">HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water"</a> ] (P)	72208	0.086	0.036	1995	The derivation of the CCC for this pollutant did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels.
[ <a href="https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water">HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water"</a> ] (P)	58899	0.95	—	1995	
[ <a href="https://www.epa.gov/wqc/quality-criteria-water-gold-book">HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book"</a> ]	—	—	—	1986	See EPAs [ <a href="https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-1236.pdf">HYPERLINK "https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-1236.pdf"</a> ] or Table 5 of this Appendix.
[ <a href="https://www.epa.gov/wqc/quality-criteria-water-gold-book">HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book"</a> ]	86500	—	0.01	1986	See [ <a href="https://www.epa.gov/wqc/quality-criteria-water-gold-book">HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book"</a> ] for narrative statement.
Heptachlor (P)	76448	0.52	0.0038	1980	These criteria are based on the [ <a href="#">HYPERLINK</a>

**Commented [WQC9]:** I included Table 5 and a link to the criteria

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					<p>"<a href="https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree">https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree</a>" ] which used different Minimum Data Requirements and derivation procedures from the [ <a href="https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations">HYPERLINK "https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations"</a> ]. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.</p>
<p>[ <a href="https://www.epa.gov/wqc/quality-criteria-water-gold-book">HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book"</a> ] (P)</p>	1024573	0.52	0.0038	1981	<p>These criteria are based on the [ <a href="https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree">HYPERLINK "https://www.epa.gov/wqc/guidelines-and-methodology-used-preparation-health-effect-assessment-chapters-consent-decree"</a> ] which used different Minimum Data Requirements and derivation procedures from the [ <a href="https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations">HYPERLINK "https://www.epa.gov/wqc/guidelines-deriving-ambient-aquatic-life-advisory-concentrations"</a> ]. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines. This value was derived from data for heptachlor and there was insufficient data to determine relative toxicities of heptachlor and heptachlor epoxide.</p>
<p>[ <a href="https://www.epa.gov/wqc/quality-criteria-water-gold-book">HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book"</a> ]</p>	7439896	—	1000	1986	<p>See [ <a href="https://www.epa.gov/wqc/quality-criteria-water-gold-book">HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book"</a> ] for narrative statement.</p>
<p>[ <a href="https://www.epa.gov/wqc/aquatic-life-criteria-lead">HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-lead"</a> ] (P)</p>	7439921	82	3.2	1984	<p>Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See [ <a href="https://www.epa.gov/wqc/office-water-policy-and-technical-guidance-interpretation-and-implementation-aquatic-life-metals">HYPERLINK "https://www.epa.gov/wqc/office-water-policy-and-technical-guidance-interpretation-and-implementation-aquatic-life-metals"</a> ].  <i>The freshwater criterion for this metal is expressed as a</i></p>

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					<i>function of hardness (mg/L). The value given here corresponds to a hardness of 100 mg/L.</i>
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	121755	—	0.1	1986	See [ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ] for narrative statement.
[ HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water" ] (P)	7439976 22967926	1.4	0.77	1995	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See [ HYPERLINK "https://www.epa.gov/wqc/office-water-policy-and-technical-guidance-interpretation-and-implementation-aquatic-life-metals" ].
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	72435	—	0.03	1986	See [ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ] for narrative statement.
[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-methyl-tertiary-butyl-ether-mtbe" ]					
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	2385855	—	0.001	1986	See [ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ] for narrative statement.
[ HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water" ] (P)	7440020	470	52	1995	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See [ HYPERLINK "https://www.epa.gov/wqc/office-water-policy-and-technical-guidance-interpretation-and-implementation-aquatic-life-metals" ]. <i>The freshwater criterion for this metal is expressed as a</i>



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					<i>function of hardness (mg/L). The value given here corresponds to a hardness of 100 mg/L.</i>
[ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-nonylphenol" ]	84852153	28 ug/L	6.6 ug/L	2005	
[ HYPERLINK "https://www.epa.gov/nutrient-policy-data/ecoregional-criteria" ]	—	—	—	—	See EPA's [ HYPERLINK "https://www.epa.gov/nutrient-policy-data/ecoregional-criteria" ] for Total Phosphorus, Total Nitrogen, Chlorophyll <i>a</i> and Water Clarity (Secchi depth for lakes; turbidity for streams and rivers) (& Level III Ecoregional criteria)
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ] [ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-dissolved-oxygen" ]	7782447	—	—	1986	See [ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ] for freshwater. For saltwater, see [ HYPERLINK "https://www.epa.gov/sites/production/files/2018-10/documents/ambient-al-wqc-dissolved-oxygen-cape-code.pdf" ]:
[ HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water" ]	56382	0.065	0.013	1995	
[ HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water" ] (P)	87865	19	15	1995	Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH and values displayed in table correspond to a pH of 7.8.  The following equations are used:

**Commented [WQC10]:** NEED TO DISCUSS. We use the DEPARTMENT CIRCULAR DEQ-12A Montana Base Numeric Nutrient Standards

**Commented [WQC11]:** NEED TO DISCUSS

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					Acute = $\text{EXP}(1.005 \cdot (\text{B26}) - 4.869)$ Chronic = $\text{EXP}(1.005 \cdot (\text{B26}) - 5.134)$
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	—	—	6.5 – 9	1986	See [ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ] for narrative statement.
Polychlorinated Biphenyls (PCBs) (P)	—	—	0.014	—	This criterion applies to total PCBs, (e.g., the sum of all congener or all isomer or homolog or Aroclor analyses.)
[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criterion-selenium" ] (P)	7782492	—	---	2016 Freshwater 1999 Saltwater	See [ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criterion-selenium-documents" ] for narrative statement.
[ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-silver" ] (P)	7440224	3.2	*0.12	1980	* EPA's Ambient WQ Criteria for Silver, October 1980, [ HYPERLINK "https://www.epa.gov/sites/production/files/2019-03/documents/ambient-wqc-silver-1980.pdf" ]
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	—	—	—	1986	See [ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ] for narrative statement.
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	7783064	—	2.0	1986	
[ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]	—	—	—	1986	Criteria is species dependent. See [ HYPERLINK "https://www.epa.gov/wqc/quality-criteria-water-gold-book" ]

**Commented [WQC12]:** Inserted the equations here rather than a footnote

**Commented [WQC13]:** Table included below, but what edits are there to do on this table?

**Commented [WQC14]:** NEED TO DISCUSS. Remove for now?

**Commented [WQC15]:** NEED TO DISCUSS

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[ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-toxaphene" ] (P)	8001352	0.73	0.0002	1986	
[ HYPERLINK "https://www.epa.gov/wqc/aquatic-life-criteria-tributyltin-tbt" ]	—	0.46	0.072	2004	
[ HYPERLINK "https://www.epa.gov/wqc/1995-updates-water-quality-criteria-documents-protection-aquatic-life-ambient-water" ] (P)	7440666	120	120	1995	
[ HYPERLINK "https://www.epa.gov/wqc/ambient-water-quality-criteria-ddt" ] (P)	50293	1.1	0.001	1980	

<sup>1</sup>**CMC:** Criterion Maximum Concentration calculated at 100 mg/L hardness for the hardness-based criteria found in **Table 2: Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent**. The criteria vary with hardness.

<sup>2</sup>**CCC:** Criterion Continuous Concentration calculated at 100 mg/L hardness for the hardness-based criteria found in **Table 2: Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent**. The criteria vary with hardness.

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<b>Table 1: Conversion Factors for Dissolved Metals</b>		
<b>Metal</b>	<b>Freshwater CMC</b>	<b>Freshwater CCC</b>
Arsenic	1.000	1.000
Cadmium	$1.136672 - [(\ln \text{ hardness})(0.041838)]$	$1.101672 - [(\ln \text{ hardness})(0.041838)]$
Chromium III	0.316	0.860
Chromium VI	0.982	0.962
Copper	0.960	0.960
Lead	$1.46203 - [(\ln \text{ hardness})(0.145712)]$	$1.46203 - [(\ln \text{ hardness})(0.145712)]$
Mercury	0.85	0.85
Nickel	0.998	0.997
Selenium	—	—
Silver	0.85	—
Zinc	0.978	0.986

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**Table 2: Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent**

Chemical	mA	bA	mC	bC	Freshwater Conversion Factors (CF)	
					CMC	CCC
Cadmium	0.9789	-3.866	0.7977	-3.909	$1.136672 \cdot [(\ln \text{hardness}) - 0.041838]$	$1.101672 \cdot [(\ln \text{hardness}) - 0.041838]$
Chromium III	0.8190	3.7256	0.8190	0.6848	0.316	0.860
Lead	1.273	-1.460	1.273	-4.705	$1.46203 \cdot [(\ln \text{hardness}) - 0.145712]$	$1.46203 \cdot [(\ln \text{hardness}) - 0.145712]$
Nickel	0.8460	2.255	0.8460	0.0584	0.998	0.997
Silver	1.72	-6.59	---	---	0.85	---
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

Hardness-dependant metals' criteria may be calculated from the following:

CMC (dissolved) =  $\exp\{mA [\ln(\text{hardness})] + bA\}$  (CF)

CCC (dissolved) =  $\exp\{mC [\ln(\text{hardness})] + bC\}$  (CF)

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**Table 3.** pH-Dependent Values of the CMC (Acute Criterion) for Ammonia

<b>CMC, total ammonia nitrogen (µg/L NH<sub>3</sub>-N plus NH<sub>4</sub>-N)</b>		
<b>pH</b>	<b>Salmonids Present</b>	<b>Salmonids Absent</b>
6.5	32600	48800
6.6	31300	46800
6.7	29800	44600
6.8	28100	42000
6.9	26200	39100
7.0	24100	36100
7.1	22000	32800
7.2	19700	29500
7.3	17500	26200
7.4	15400	23000
7.5	13300	19900
7.6	11400	17000
7.7	9650	14400
7.8	8110	12100
7.9	6770	10100
8.0	5620	8400
8.1	4640	6950
8.2	3830	5720
8.3	3150	4710
8.4	2590	3880
8.5	2140	3200
8.6	1770	2650
8.7	1470	2200
8.8	1230	1840
8.9	1040	1560
9.0	885	1320

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**Table 4.** Temperature and pH-Dependent Values of the CCC (Chronic Criterion) for Fish Early Life Stages Present and for Fish Early Life Stages Absent

CCC for Fish Early Life Stages Present, total ammonia nitrogen (µg/L NH <sub>3</sub> -N plus NH <sub>4</sub> -N)										
pH	Temperature, °C									
	0	14	16	18	20	22	24	26	28	30
6.5	6670	6670	6060	5333	4680	4120	3620	3180	2800	2460
6.6	6570	6570	5970	5250	4610	4050	3560	3130	2750	2420
6.7	6440	6440	5860	5150	4520	3980	3500	3070	2700	2370
6.8	6290	6290	5720	5030	4420	3890	3420	3000	2640	2320
6.9	6120	6120	5560	4890	4300	3780	3320	2920	2570	2250
7.0	5910	5910	5370	4720	4150	3650	3210	2820	2480	2180
7.1	5670	5670	5150	4530	3980	3500	3080	2700	2380	2090
7.2	5390	5390	4900	4310	3780	3330	2920	2570	2260	1990
7.3	5080	5080	4610	4060	3570	3130	2760	2420	2130	1870
7.4	4730	4730	4300	3780	3320	2920	2570	2260	1980	1740
7.5	4360	4360	3970	3490	3060	2690	2370	2080	1830	1610
7.6	3980	3980	3610	3180	2790	2450	2160	1900	1670	1470
7.7	3580	3580	3250	2860	2510	2210	1940	1710	1500	1320
7.8	3180	3180	2890	2540	2230	1960	1730	1530	1330	1170
7.9	2800	2800	2540	2240	1960	1730	1520	1330	1170	1030
8.0	2430	2430	2210	1940	1710	1500	1320	1160	1020	897
8.1	2101	2101	1910	1680	1470	1290	1140	1000	879	773
8.2	1790	1790	1630	1430	1260	1110	973	855	752	661
8.3	1520	1520	1390	1220	1070	941	827	727	639	562
8.4	1290	1290	1170	1030	906	796	700	615	541	475
8.5	1090	1090	990	870	765	672	591	520	457	401
8.6	920	920	836	735	646	568	499	439	386	339
8.7	788	788	707	622	547	480	422	371	326	287
8.8	661	661	601	528	464	408	359	315	277	244
8.9	565	565	513	451	397	349	306	269	237	208
9.0	486	486	442	389	342	300	264	232	204	179

**Table 3 and Table 4 - Additional Information**

The ammonia tables (**Table 3** and **Table 4**) take the following factors into account in determining the maximum values of NH<sub>3</sub>-N plus NH<sub>4</sub>-N allowable for chronic and acute exposures for Salmonid species and specific life stages.

- The toxicity of ammonia (measured as total µg/L NH<sub>3</sub>-N plus NH<sub>4</sub>-N) is a function of the pH and Temperature of the water. The chronic toxicity includes both pH and temperature factors and the acute toxicity include only the pH factor.
- Both the acute (CMC) and chronic (CCC) criterion for Ammonia varies by whether Salmonid species are present or absent and by whether the early life stages of fish are present or absent.

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- At 15 °C and above, the criterion for fish Early Life Stages absent is the same as the criterion for fish Early Life Stages present.

**Table 5: Water Quality Criteria for Ambient Dissolved Oxygen Concentration**

	<u>Coldwater Criteria</u>		<u>Warmwater Criteria</u>	
	Early Life Stages <sup>1, 2</sup>	Other Life Stages	Early Life Stages <sup>2</sup>	Other Life Stages
30 Day Mean	NA <sup>3</sup>	6.5	NA	5.5
7 Day Mean	9.5 (6.5)	NA	6.0	NA
7 Day Mean Minimum	NA	5.0	NA	4.0
1 Day Minimum <sup>4,5</sup>	8.0 (5.0)	4.0	5.0	3.0

<sup>1</sup> These are water column concentrations recommended to achieve the required intergravel dissolved oxygen concentrations shown in parentheses. The 3 mg/L differential is discussed in the criteria document. For species that have early life stages exposed directly to the water column, the figures in parentheses apply.

<sup>2</sup> Includes all embryonic and larval stages and all juvenile forms to 30-days following hatching.

<sup>3</sup> NA (not applicable).

<sup>4</sup> For highly manipulatable discharges, further restrictions apply.

<sup>5</sup> All minima should be considered as instantaneous concentrations to be achieved at all times.



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**Table 6. Selenium Aquatic Life Criteria for Fresh Waters**

<b>Criterion Element</b>	<b>Magnitude</b>	<b>Duration</b>	<b>Frequency</b>
Fish Tissue <sup>a</sup> (Egg-Ovary) <sup>b</sup>	15.1 mg/kg dw	Instantaneous measurement <sup>c</sup>	Not to be exceeded
Fish Tissue <sup>a</sup> (Whole Body or Muscle) <sup>d</sup>	8.5 mg/kg dw or 11.3 mg/kg dw muscle (skinless, boneless filet)	Instantaneous measurement <sup>c</sup>	Not to be exceeded
Water Column <sup>e</sup> (Monthly Average Exposure)	1.5 µg/L in lentic aquatic systems  3.1 µg/L in lotic aquatic systems	30 days	Not more than once in three years on average
Water Column <sup>e</sup> (Intermittent Exposure) <sup>f</sup>	$WQC_{int} = \frac{WQC_{30-day} - C_{bkgrnd}(1 - f_{int})}{f_{int}}$	Number of days/month with an elevated concentration	Not more than once in three years on average

<sup>a</sup> Fish tissue elements are expressed as steady-state.

<sup>b</sup> Egg/ovary supersedes any whole-body, muscle, or water column element when fish egg/ovary concentrations are measured.

<sup>c</sup> Fish tissue data provide point measurements that reflect integrative accumulation of selenium over time and space in fish population(s) at a given site.

<sup>d</sup> Fish whole-body or muscle tissue supersedes water column element when both fish tissue and water concentrations are measured.

<sup>e</sup> Water column values are based on dissolved total selenium in water and are derived from fish tissue values via bioaccumulation modeling. Water column values are the applicable criterion element in the absence of steady-state condition fish tissue data.

<sup>f</sup> Where  $WQC_{30-day}$  is the water column monthly element, for either a lentic or lotic waters;  $C_{bkgrnd}$  is the average background selenium concentration, and  $f_{int}$  is the fraction of any 30-day period during which elevated selenium concentrations occur, with  $f_{int}$  assigned a value  $\geq 0.033$  (corresponding to 1 day).

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Table 7: Ammonia Equations	
Ammonia, 30-day average	
Acute, 1-hour average, <i>Oncorhynchus</i> absent	$0.7249 * ((0.0114 / (1 + (\text{POWER}(10, 7.204 - \text{pH}))) + (1.6181 / (1 + (\text{POWER}(10, \text{pH} - 7.204)))) * \text{MINIMUM}(51.93, 23.12 * (\text{POWER}(10, 0.036 * (20 - \text{TEMP}))))$
Acute, 1-hour average, <i>Oncorhynchus</i> present	$\text{MINIMUM}((0.275 / (1 + (\text{POWER}(10, 7.204 - \text{pH}))) + (39 / (1 + (\text{POWER}(10, \text{pH} - 7.204))))$
Chronic, 30-day rolling average*	$0.8876 * ((0.0278 / (1 + (10 * (\text{POWER}(7.688 - \text{pH})))) + (1.1994 / (1 + (10 * (\text{POWER}(\text{pH} - 7.688)))) * (2.216 * 10 * (\text{POWER}(0.028 * (20 - \text{MAXIMUM}(\text{TEMP}, 7))))$

\* not to exceed 2.5 times the chronic as a 4-day average within 30 days